EVALUATION OF THE USE OF DATA ANALYTICS BY UNIVERSITY RESEARCH ADMINISTRATION OFFICES TO MONITOR FINANCIAL COMPLIANCE

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Abstract

In the age of big data, university research administration offices have both the opportunity and responsibility to utilize the vast amounts of institutional data available to them for compliance oversight. Institutions are increasingly using data analytics to monitor grants and other sponsored programs for financial compliance with the post-award administrative requirements of federal regulations, sponsor guidelines, award terms and conditions, and university policies. The primary catalyst for the increased use of data analytics in university research administration was the deployment of data analytic audits by the federal government to increase accountability and transparency over federal funding. In conducting these audits, the government utilized data analytics to target higher-risk financial activities. Some universities have leveraged the knowledge gained from these audits to proactively implement their own data analytic programs to monitor financial compliance.

The purpose of this research study was to better understand the core elements of a successful compliance analytics program. The core elements identified in the study include (1) adequate resources to support the program such as staffing and reporting tools, (2) comprehensive risk assessment of the internal and external factors impacting financial compliance, (3) good quality of data and methods such as accurate and consistent capture of data and systematic ways to query, analyze, and report the data, (4) actionable information that exposes problems and identifies trends for potential intervention to prevent future occurrences, and (5) timely and effective reporting of the results to drive accountability for compliance throughout the institution.

Reader: Jeffrey E. Kantor

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Chapter 1

Introduction

University research administration offices are increasingly using data analytics as a tool to monitor financial compliance of grants and other sponsored programs. In this context, data analytics is defined as the process of analyzing sponsored programs data with the objective of drawing meaningful conclusions about a university's financial compliance with federal regulations, sponsor guidelines, award terms and conditions, and university policies. The purpose of this study is to better understand the core elements of a successful compliance analytics program.

Objective of Data Analytics

Data analytics turns raw data into actionable information to support specific objectives. Whittemore, Freese, and Lucido (2017) more aptly referred to data analytics as "decision analytics" and described the use of data analytics in progressive levels of sophistication. These levels included descriptive analytics of reporting what happened, diagnostic analytics of analyzing why it happened, predictive analytics of modeling what will happen next, and prescriptive analytics of intervening to optimize what will happen next (Whittemore et al., 2017). An example in research administration of using data analytics at increasing levels of complexity is monitoring cost transfers for financial compliance by (1) tracking the number of cost transfers initiated by academic departments each month, (2) determining the root cause for high levels of cost transfers by a department, (3) projecting the cumulative number and dollar value by the end of the year to compare to tolerable levels established by the institution from a risk perspective, and (4) intervening when necessary with departmental training or other measures to prevent further occurrences.

Role in Internal Control

The use of data analytics can complement an institution's overall strategy for developing internal controls to manage risk. The Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards issued by the federal Office of Management and Budget (OMB), commonly referred to as the Uniform Guidance, contains the requirements for federal grants management including pre- and post-award administration, principles for determining the allowability of costs, and the requirements for external audits. The post-award administrative requirements require universities to "establish and maintain effective internal control…that provides reasonable assurance" (§200.303) that the institution is complying with the laws, regulations, and terms and conditions of federal awards, including monitoring for compliance and taking prompt action in instances of noncompliance (OMB, 2014). The Uniform Guidance also requires that internal controls meet the standards of the Internal Control Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO, 2013). The COSO model describes a risk-based approach for developing appropriate internal controls over operations, reporting, and compliance. Further guidance provided by the Institute of Internal Auditors (Anderson and Eubanks, 2015) expands the COSO model by defining the roles and responsibilities associated with risk management and internal controls. According to Anderson and Eubanks (2015) the three lines of defense in managing risk and control are the first line operating management with ownership of the risk and control, the second line compliance functions monitoring the risk and control, and the third line audit functions providing independent assurance regarding the effectiveness of the control in managing the risk. A data analytics program can assist a university research administration office in carrying out its responsibilities for monitoring financial compliance by providing methods for oversight of risks and internal controls.

Impact of Regulatory Environment

The use of data analytics to monitor grant financial compliance originated with the federal government. The Federal Funding Accountability and Transparency Act of 2006 (FFATA) signed into law by President George W. Bush on September 26, 2006 ushered in the era of government transparency by requiring data on entities receiving federal funding to be made available to the public on a searchable website. The bill introducing FFATA was co-sponsored by then Senator Barak Obama to make federal funding for grants and contracts open to public scrutiny to mitigate the potential for fraud and abuse.

Subsequently President Obama furthered the government transparency initiative when he signed the American Recovery and Reinvestment Act of 2009 (ARRA) into law on February 17, 2009. The ARRA placed strict reporting requirements on entities receiving federal funding to stimulate economic recovery from the recession and established the Recovery Accountability and Transparency Board (RATB) that included the Inspectors General of ten federal agencies, to provide oversight of the funding to prevent fraud, waste, and abuse. The RATB established the Recovery Operations Center that incorporated the use of data analytics as a new monitoring tool to ensure the ARRA funds were used appropriately. Although the RATB was officially terminated in 2015, the technique of using data analytics to monitor the use of federal funds continued to be embraced by members of the Inspectors General community.

On May 9, 2014, the transparency initiative was bolstered again when President Obama signed the Digital Accountability and Transparency Act of 2014 (DATA) that expanded FFATA and called for the data analytic techniques developed by the RATB to be applied to spending across the federal government. Although the DATA Act authorized the U.S. Department of Treasury to establish a data analysis center to provide federal agencies with data, analytic tools,

and data management techniques to support the prevention and reduction of improper payments, the Treasury Department was reluctant to serve as the government-wide center for data analytics. As a result, when the Fraud Reduction and Data Analytics Act of 2015 (FRDAA) was signed into law by President Obama on June 30, 2016, the legislation established a working group to be led by the OMB to develop a plan for a federal interagency data analytics library for the sharing and development of techniques to identify and prevent fraud, including improper payments. According to a recent report on the status of the implementation of FRDAA, the central data analytics library has not been fully implemented (U.S. Government Accountability Office, 2018). Further actions of the federal government related to data analytics will likely continue to impact the approach that university research administration offices take in using data analytics to monitor grants and other sponsored programs for financial compliance.

Chapter 2

Literature Review

Luther and Cole (2015, May/June) described the beginnings of a financial compliance monitoring program at Duke University that began in the 2007 to 2008 timeframe as part of a university-wide initiative to identify, assess, and mitigate compliance risk.

> The program started with the development of a comprehensive inventory of potential financial compliance risks. RCC [the Office of Research Costing Compliance] developed a lengthy list of items gleaned from audits of peer institutions, basic compliance requirements, and feedback from a representative group of practitioners. Each item was evaluated for potential risk level and impact on the institution. A reporting structure was developed that ensured senior leadership would be well-informed of data analysis outcome and resulting recommendations. (p. 12)

In addition to monitoring financial compliance, the data analytics program at Duke has evolved into a research administration tool to inform training programs based on the results of analytics and to balance workloads based on a sponsored program "Portfolio Complexity Index" (Luther and Cole, 2015, May/June, p.13).

For many universities though the turning point toward data analytics occurred when the National Science Foundation Office of Inspector General (NSF-OIG) deployed the use of data analytics to conduct grantee audits. The NSF-OIG (2012) first used data mining and data analytics in 2010 to meet its responsibilities under ARRA by using these new techniques to target higher-risk awardees for audit and to target financial areas prone to waste or abuse during the audit. In a report on the lessons learned from the implementation and oversight of ARRA

funding, the NSF-OIG (2012) affirmed that the OIG would continue to incorporate data analytics in future audits as the new audit techniques enabled the office to work more efficiently and effectively by targeting their efforts toward higher-risk awardees and by providing full coverage of an awardee's transactions as opposed to a sample of transactions.

Similarly, the federal interagency compilation of lessons learned from ARRA recognized that administration of the supplemental funding within a short time frame required agencies to operate more effectively (U.S. Department of Interior, 2013). Agencies used risk analysis to focus their efforts on riskier programs such as new or high-dollar programs, and riskier awardees. Agencies also relied on the data mining and analytic expertise provided by the Recovery Operations Center. The report encouraged agencies to continue to employ the beneficial practices brought about by the administration of the ARRA funds.

Baker (2015) described the various sources of data used by the NSF-OIG in using automated techniques to conduct grantee audits including internally-available data from proposal budgets, progress reports, and cash drawdown records, externally-available data from other government systems on excluded parties and single audit findings, and grant recipient data from the general ledger, subsidiary ledgers, and travel and purchase card records. Baker (2015) also described the compliance risks associated with the various stages of the grant life cycle such as eligibility and conflict of interest concerns during the pre-award phase, unallowable costs charged to grants during the active award phase, and costs incurred outside of the period of performance, inappropriate cost transfers, and late, incomplete or missing final reports during the award end and close out phase.

The increasing use of data analytics by universities is partly in response to the implementation of data analytics audits by federal oversight agencies in conducting grantee

audits. However, some institutions are taking a proactive approach and using data analytics for their own self-assessment purposes, as well as to be prepared for audits (Sullivan, 2015). Sullivan (2015) suggested that universities develop metrics focused on specific compliance areas such as:

- completion of effort reports,
- cost transfers including late salary transfers,
- cost overruns,
- timeliness of financial closeouts,
- expenditures after the period of performance, and
- unexpended cost sharing budgets.

Normandy, Larmett, and Clark (2015) noted the opportunity for universities to leverage the resources already invested by the federal government in developing a "set of analytic markers" (p. 49) to implement their own proactive monitoring techniques to reduce their exposure to potential audit findings. Based on the data analytic audits conducted by the NSF-OIG, Normandy et al. (2015) provided examples of markers or red flags for universities to consider in developing their own programs such as:

- anomalous expenditure patterns particularly around the award start and end dates or in comparison to the time elapsed on the project,
- spending on items outside of the approved budget categories,
- cost transfers, and
- higher-risk transactions such as those involving subcontracts, travel, and equipment purchases.

The evolution of financial compliance monitoring to incorporate data analytics has been enabled by advances in technology allowing universities to move from manual to electronic records and to access and analyze data in new ways. Villalobos (2018) described the value of electronic research administration (eRA) systems in both responding to data requests during a federal data analytics audit and providing the ability to replicate the analytics model for internal monitoring of financial compliance. The benefits of an eRA system noted by Villalobos (2018) included formalized system documentation such as data dictionaries and process flowcharts, data warehousing to integrate data from multiple systems, electronic document storage, electronic workflow approvals, and querying and reporting capabilities.

In the future, effective data analytics programs could potentially contribute to the favorable evaluation of an institution's grant management environment by federal auditors and the reduction of audit exposure. Lish (2019) described the more measured approach to grantee audits that the NSF-OIG has recently implemented that initially evaluates the grantee's overall grant management environment to inform the type of audit to be conducted such as an "accounting system audit, incurred cost audit, internal control audit, or customized audit based on identified risks, or if it is determined that the auditee has an exceptional grant management system, terminating the audit" (p. 33).

Chapter 3

Statement of Problem

A recent joint statement by the Association for Institutional Research, EDUCAUSE, and the National Association of College and University Business Officers (2019) recognized data as an institutional strategic asset and underscored the sluggish progress of universities in adopting data analytics to support strategic decision making. However, for university research administration offices, the use of data analytics to monitor financial compliance of grants and other sponsored programs has gained momentum due to the impact of the regulatory environment. Corporations have also recognized the emerging need to use data analytics to support corporate compliance objectives.

> In a world where more and more data is available in the corporate context, companies need to assess if their compliance programs would be deemed effective in preventing and detecting misconduct if they simply ignored data that was available. Using available data in an effort to proactively identify potential issues looks to be the next step in bringing compliance in line with the reality that there is now massive amounts of data available to a company… (Bloor and O'Connor, 2018, Q&A No. 8)

Similarly, could university research administration offices be considered negligent in monitoring financial compliance if they are not fully and effectively using this institutional asset? In consideration of this question, the purpose of this research study is to better understand the core elements of a successful compliance analytics program to enable university research administration offices to implement or enhance data analytic programs that strategically use this institutional asset.

Chapter 4

Research Methodology

A survey of university post-award research administrators was conducted to evaluate their use of data analytics to monitor financial compliance of grants and other sponsored programs (See Appendix A).

Participants

The survey was directed towards individuals working in university post-award research administration positions since post-award management entails monitoring of sponsored programs for financial compliance. Preference was given to individuals in management-level roles such as Directors, Assistant Directors, or Managers due to their broader perspective on the tools currently used by the institution to monitor financial compliance. Since the research involved human participants, information on the research study, including the survey instrument, was submitted to the Institutional Review Board for review and approval (See Appendix B).

Research Design

The survey was primarily descriptive in nature to gain a better understanding of the core elements of successful compliance analytics programs used by university research administration offices. Ten of the twelve questions on the survey instrument were quantitative using closed questions and rating scales. The other two questions were qualitative open-ended questions seeking participant opinions on the necessary elements of compliance analytics programs. Additionally, respondents that indicated that they did not use data analytics were asked one open-ended question to determine the primary reason for not using data analytics.

Survey

The purpose of the survey was to assess whether respondents use data analytics to monitor financial compliance, and if so, to provide information on the program including the

- degree to which the program has been implemented,
- prioritization of compliance areas to be monitored,
- involvement of the internal audit department,
- benefits experienced from implementing the program,
- reports on the results of data analytics, and
- use of the results to inform training programs.

Finally, respondents were asked to rate the effectiveness of their program and provided the opportunity to respond to open-ended questions as to what they think makes a good data analytics program and what would improve their current program.

Procedure

The universities sampled for the survey were identified from research expenditure data published by the National Science Foundation's National Center for Science and Engineering Statistics (2018) from its Higher Education Research and Development Survey. A total of 643 institutions reported externally-funded research expenditures for fiscal year 2017. Of those institutions, 342 reported less than $10 million in annual expenditures and were excluded from the population to be sampled since these institutions would be less likely to utilize data analytics as a tool due to the lower volume of expenditure transactions. A sample of the remaining 301 institutions was selected for receipt of the survey. A sample size of 170 was determined to be appropriate based on a power analysis using a 95% confidence level and a 5% margin of error. The institutions were sorted in descending order of research expenditures with every other

institution being selected starting with the second institution to yield 150 institutions. The remaining 20 institutions, as well as any substitute institutions due to the unavailability of participant email addresses, were selected at random from the population to represent various expenditure levels.

For the institutions selected for the sample, an email was sent to a representative individual working in post-award research administration. Email addresses were obtained from the available contact information provided by the office on its website with one email being returned as undeliverable. Participation in the survey was anonymous to encourage openness in responses regarding financial compliance. The survey did not contain any questions that could identify the individual or the university. Google Forms was the web-based application used to conduct the survey and analyze the results at both the collective level for the quantitative questions and the institution level for the open-ended questions.

Chapter 5

Data Analysis

Representatives from 32 universities responded to the survey resulting in a 19% response rate. Participation in the survey was anonymous for both the individual and the represented institution. When asked whether the university's research administration offices used data analytics to monitor financial compliance of grants or other sponsored programs, 18 of the 32 institutions responded affirmative and 14 institutions indicated that they did not use data analytics as shown in Figure 1.

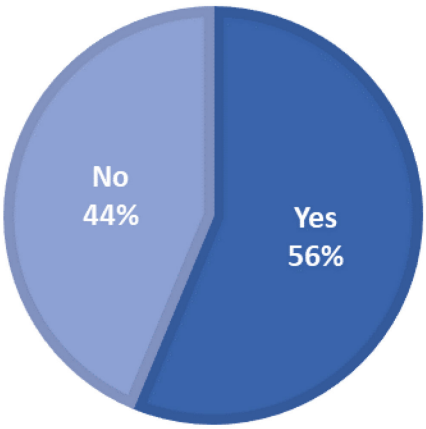

Figure 1. Use of Data Analytics. Do your university's research administration offices use data analytics to monitor financial compliance of grants or other sponsored programs? (32 responses)

Of the institutions that do not use data analytics, 10 of 14 or 71% of the respondents indicated in an open-ended question that lack of resources was the primary reason for not using data analytics. The respondents mentioned the lack of tools, analytics knowledge, systems, and staff to support a data analytics program (See Appendix C, Table C1). The survey response supports the findings of the EDUCAUSE Maturity Index that measured the maturity of analytics at higher education institutions using six dimensions: culture, policies, data efficacy, resources,

technical infrastructure, and involvement of the institutional research unit (Dahlstrom, 2016). Of the six dimensions, the least mature was the investment in resources, primarily the investment in staffing to support analytics (Dahlstrom, 2016). The importance of analytics to an institution as gauged by the investment at the institution level impacts the availability of resources at the research administration level.

Of the 18 institutions that use data analytics, 83% reported an annual level of externally-funded research expenditures greater than $100 million. The median response of these institutions was three on a scale of zero to five when asked to gauge the degree of implementation of data analytics by their university's research administration offices as a tool to monitor financial compliance of grants or other sponsored programs as shown in Figure 2.

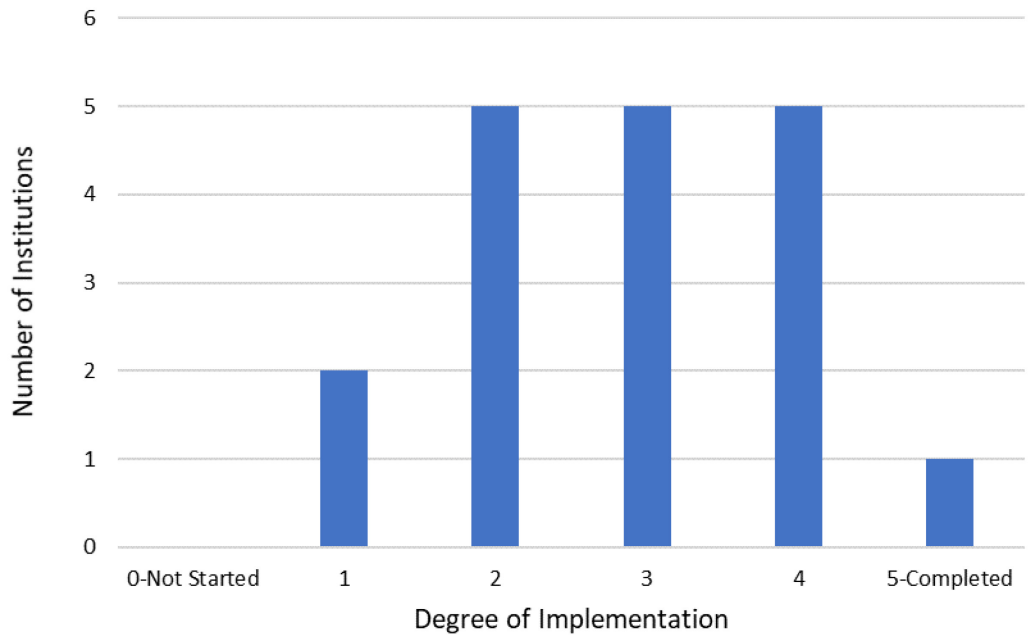

Figure 2. Degree of Implementation of Data Analytics. To what degree have your university's research administration offices implemented data analytics as a tool to monitor financial compliance of grants or other sponsored programs? (18 responses)

As shown in Figure 3, institutions prioritize the areas of financial compliance to be monitored using data analytics primarily based on the likelihood of the area to be audited or an assessment of the risks associated with their sponsored programs portfolio. The survey response suggests that risk assessment is not performed in an institutional vacuum but requires the evaluation of factors both internal and external to the institution. Zuskar and Sullivan Pifer (2019) posited data analytics as "a proactive tool for self-governance, or…a reactive one in response to an audit" (p. 1). The survey indicates in practice data analytics is used for both purposes.

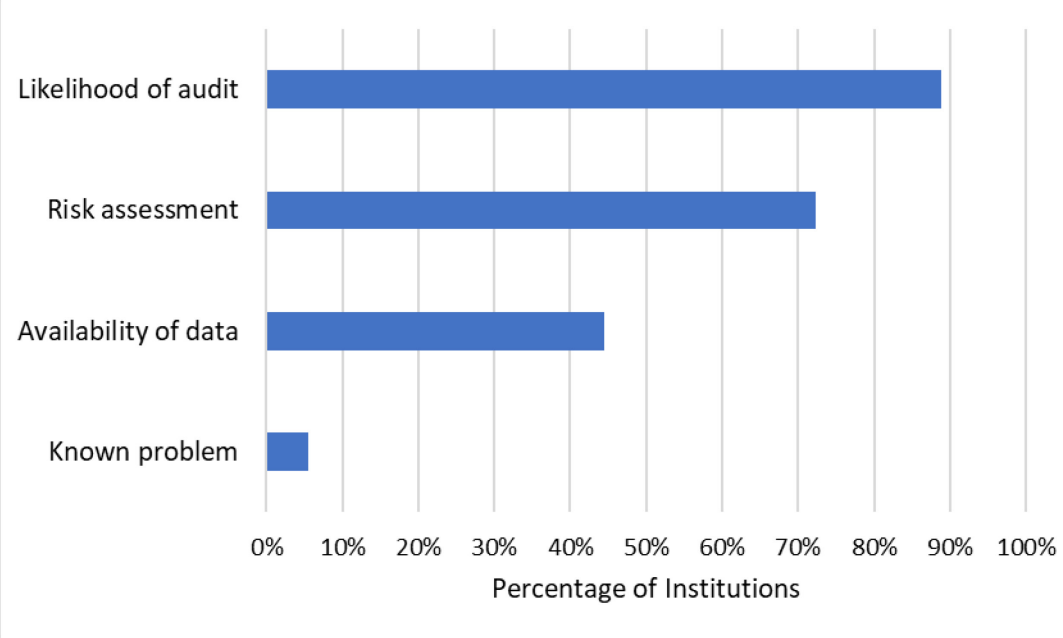

Figure 3. Prioritization of Areas to be Monitored Using Data Analytics. How do your university's research administration offices prioritize the financial compliance areas to be monitored using data analytics (select all that apply)? (18 responses)

According to the survey responses, 72% of institutions did not collaborate with their internal audit office in the implementation of their data analytics program. This may be because university research administration offices house the expertise to effectively identify the areas of

risk and design the necessary controls to manage the risks in this specialized area of financial compliance for grants and other sponsored programs. However, within an institution's framework of internal controls, although compliance oversight is generally a management function of the central research administration offices, the internal audit function provides independent assurance to executive leadership of the effectiveness of the oversight mechanisms in mitigating risk. According to the survey, 28% of the institutions saw the value in consulting with their internal audit offices on the front-end design of their data analytics program.

From a monitoring perspective, the surveyed institutions identified the primary benefits experienced from using data analytics as the exposure of potential problems sooner and the ability to identify trends as shown in Figure 4.

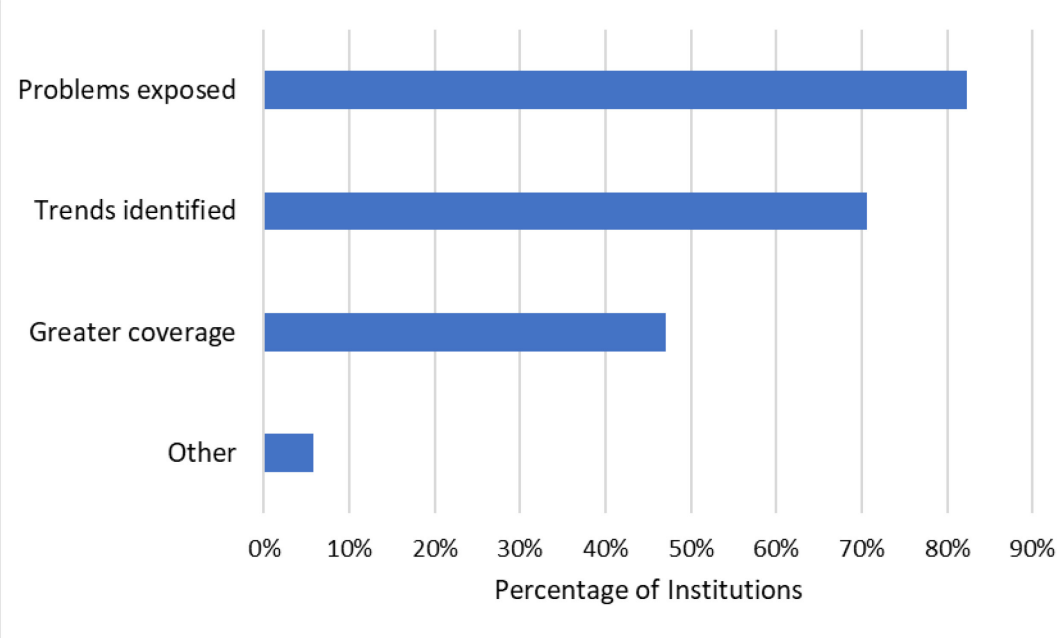

Figure 4. Benefits Experienced from Using Data Analytics. From a monitoring perspective, what benefits have your university's research administration offices experienced by using data analytics (select all that apply)? (17 responses)

Additionally, 78% of the survey respondents use trends in data analytic findings, such as recurring types of questioned costs or repeat offending departments, to inform training programs. These types of benefits support basic objectives of internal control activities for post-award research administration offices to detect and prevent instances of noncompliance with the financial requirements of grants or other sponsored programs. The survey results are analogous with the evolution of financial compliance oversight at Duke University into a comprehensive program that integrates monitoring with training as described by Luther and Cole (2015, August). Research administration offices increase the effectiveness of data analytics in monitoring financial compliance by investigating root causes in problem areas, identifying trends, and integrating the results into new or revised training programs to prevent further occurrences.

Eight of 14 survey respondents or 57% identified in an open-ended question that quality data and/or systematic methods of querying and reporting results on a timely basis were another mark of a good data analytics program (See Appendix C, Table C2). The survey results are consistent with the experience of Villalobos (2018) in describing the importance of an eRA system in supporting an NSF-OIG data analytics audit and in replicating the audit model for use as an internal monitoring mechanism. When survey respondents were asked whether they provide summary reports to communicate the results of data analytics, 39% indicated they provide reports to academic units at the dean or department level and 56% indicated they provide reports to executive leadership as displayed in Figure 5.

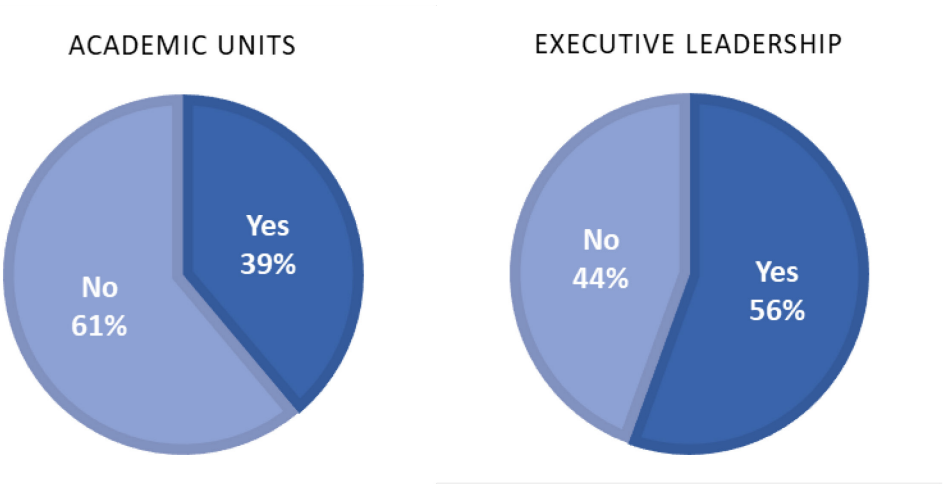

Figure 5. Reporting of Results of Data Analytics.

Do your university's research administration offices provide summary reports to academic units (dean or department level) to communicate the results of data analytics? (18 responses)

Do your university's research administration offices provide summary reports to executive leadership (Provost or Vice President of Research) to communicate the results of data analytics? (18 responses)

When asked what would improve the current data analytics program used by their university's research administration offices, survey respondents primarily identified the following kinds of improvements (See Appendix C, Table C3):

- more staffing resources to analyze data and develop reports,
- more robust reporting capabilities, and
- better data and the ability to integrate data from multiple systems.

Although the survey showed moderate percentages of university research administration offices reporting on the results of data analytics, institutions seem to recognize the importance of communicating the results of data analytics, but do not currently have the appropriate level of resources and system capabilities to support the reporting function. As shown in Figure 6, the median response of the surveyed institutions was three on a scale of one to five when asked to

rate the overall effectiveness of their current data analytics program in monitoring financial compliance of grants or other sponsored programs.

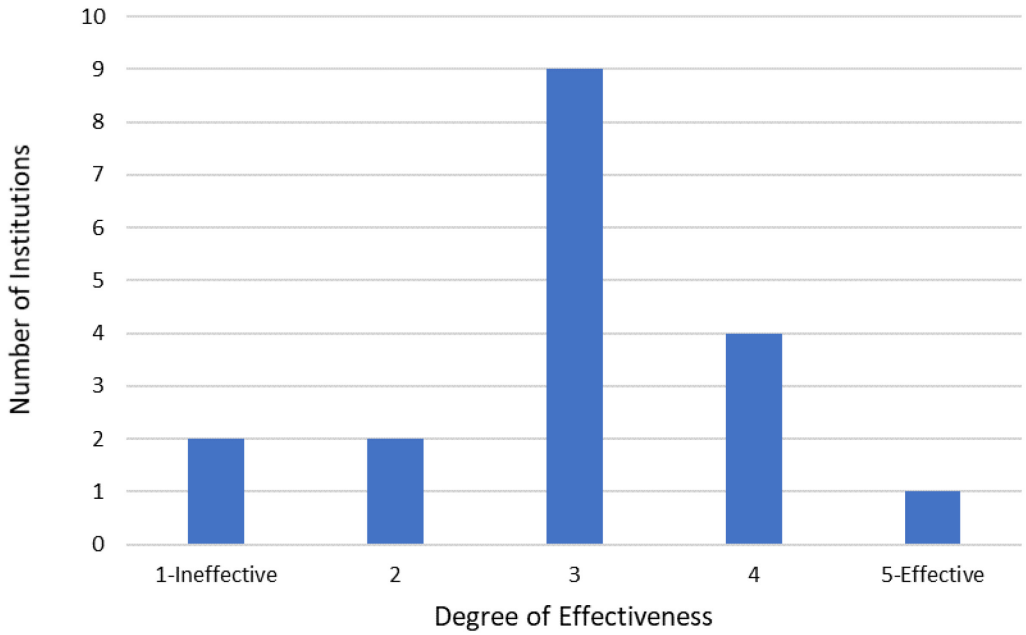

Figure 6. Effectiveness of Current Data Analytics Program. How would you rate the overall effectiveness of the current data analytics program used by your university's research administration offices to monitor financial compliance of grants or other sponsored programs? (18 responses)

Chapter 6

Discussion of Data Results

Results

Based on the responses to the survey, over half of the university research administration offices use data analytics to monitor financial compliance of grants or other sponsored programs. Of the universities that use data analytics, most have an annual level of externally-funded research expenditures greater than $100 million. The median degree of implementation in using data analytics as a tool to monitor financial compliance was three on a scale of zero to five ranging from having not started implementation to having completed implementation. The survey respondents provided the following information on the features of their data analytics programs.

- The institutions prioritize the financial compliance areas to be monitored using data analytics primarily based on the likelihood of the area to be audited and a risk assessment of the institution's sponsored programs portfolio.
- Most institutions did not collaborate with the internal audit office in implementing the data analytics program.
- The institutions experienced benefits in using data analytics to monitor financial compliance primarily from exposing problems sooner and identifying developing trends.
- Most institutions use trends in data analytic findings, such as recurring types of questioned costs or repeat offending departments, to inform training programs.
- Some institutions provide summary reports to academic units (dean or department level) to communicate the results of data analytics. More institutions provide these types of reports to executive leadership, such as the Provost or Vice President for Research.

- The institutions identified quality data and systematic methods of querying and reporting data as another mark of a good data analytics program.

The institutions rated the overall effectiveness of their data analytics program in monitoring financial compliance as a three on a scale of one to five ranging from ineffective to effective. When asked what would improve their current data analytics program, the institution responses primarily included more staff to analyze data and develop reports, more robust reporting capabilities, and better data including the ability to integrate data from multiple systems.

For institutions that do not use data analytics to monitor financial compliance, lack of resources was identified as the primary reason for not implementing a data analytics program. These institutions identified the need for more tools, analytics knowledge, systems, and staff to implement a program.

Discussion

Some themes emerged from the responses to the survey to evaluate the use of data analytics by university research administration offices to monitor financial compliance.

- The use of data analytics is a developing trend with universities with the most research expenditures leading the trend. Since higher levels of expenditures generally increase the likelihood of an institution being selected for audit by a sponsoring agency, these universities are also the ones who are most likely to be impacted by the deployment of data analytic audits by the federal government. The implementation of data analytic programs could partly be reactionary from experiencing an audit or precautionary to be prepared for this type of audit.

- Data analytics programs are currently in moderate stages of development since this is a relatively new tool for research administration offices and higher education in general has been slow to invest in the use of data analytics. Limited resources can be a barrier to either the implementation of a data analytics program or a deterrent to the enhancement of an existing data analytics program.
- University research administration offices view data analytics as an internal control to mitigate internal and external risk factors associated with their sponsored program portfolios. Deployment of a data analytics program is usually driven by research administration offices rather than internal audit offices likely because central research administration owns the responsibility and houses the expertise for compliance oversight.
- The data analytics tool meets the requirements of the Uniform Guidance for ongoing monitoring and prompt correction of instances of noncompliance by enabling university research administration offices to expose problems sooner, identify trends, and intervene with training programs as a preventive measure to future occurrences.
- Reporting is an area of improvement needed for data analytic programs to become more effective. For some institutions reporting is weak due to a lack of resources rather than a perceived lack of importance. University research administration offices must be strategic in the use of available resources to communicate the results of data analytics in ways that enable executive leadership to discern the value of data analytics in monitoring compliance oversight and be willing to increase the institution's investment in resources to support the program.
- Good quality of data and methods of analysis and reporting are foundational to the integrity of a data analytics program.

Chapter 7

Conclusions and Recommendations

Conclusions

Based on analysis of the results of the survey to evaluate the use of data analytics by university research administration offices to monitor financial compliance, the core elements of a successful compliance analytics program include:

- adequate resources to support the program such as staffing and reporting tools,
- comprehensive risk assessment of the internal and external factors impacting financial compliance,
- good quality of data and methods such as accurate and consistent capture of data and systematic ways to query, analyze, and report the data,
- actionable information that exposes problems and identifies trends for potential intervention to prevent future occurrences, and
- timely and effective reporting of the results to drive accountability for compliance throughout the institution.

Since a compliance analytics program serves as an internal control to monitor financial compliance, or the second line of defense referred to by Anderson and Eubanks (2015), these core elements must be considered within the larger internal control framework of the institution. Table 1 shows how the core elements of a data analytics program assimilate into the five integrated components of the COSO (2013) framework. Although collaboration with internal audit is not considered a core element, that aspect of a data analytics program is also shown in Table 1 for those institutions that choose to include internal audit in the implementation phase of the program.

Table 1

Assimilation of Core Elements of Data Analytics Program into COSO Framework

COSO Component	COSO Characteristics	Data Analytics Program
Control environment	Board and senior management set the tone at the top on the importance of internal controls	Adequate resources to support the program
Risk assessment	Risks are identified and analyzed to determine how to manage	Risk assessment of factors impacting financial compliance
Control activities	Actions taken to mitigate risks	Good data and methods; Actionable information
Information and communication	Relevant information flows up, down, and across the entity	Timely and effective reporting of results
Monitoring activities	Ongoing independent evaluation that internal controls are present and functioning	Optional: Collaboration with internal audit to identify risk and design controls

The control environment established by the board and senior management encompasses decisions regarding the allocation of resources to most effectively drive accountability for internal control activities across the institution. Reporting the results of data analytics to executive leadership can demonstrate the effectiveness and value of a data analytics program in monitoring financial compliance. The Protiviti consulting group offered this view on the value of continuous monitoring:

> Anytime you're dealing in real time, it shifts the dynamic from triage after the fact to saying, 'Here's what we found. Here's what we fixed. Here's what we're doing differently already,' by the time you report to the board. It compresses the dynamic of audit identification and problem-solving. It can compress it in a way

> that you can report the solution, if not the status. (Tysiac, 2015, Do benefits outweigh costs? section, para. 7)

For universities that identified inadequate resources as a hindrance to the effectiveness of their current data analytic programs, reporting to management on this proactive approach to compliance monitoring could potentially influence management decisions to increase the institution's investment in resources to support the program.

For the risk assessment, central university research administration offices generally house the expertise to identify risks and design effective internal controls to mitigate the risks. However, some universities leverage their efforts by collaborating with their internal auditors who share responsibility in the COSO framework with the external auditors to perform the subsequent monitoring activities to determine internal controls are present and functioning properly. Consultation with the internal audit office on the design of the controls to mitigate risk could be helpful in facilitating the future monitoring of those controls by internal auditors.

For control activities to be effective they must be based on accurate data and consistent methods of analysis to provide both executive leadership and academic units with confidence in the reported results of data analytics. Control activities must also result in actionable information that might include the review of policies and procedures, documentation standards, training programs, business processes, or internal controls to determine and address the root cause of data analytic findings (Sullivan, 2015).

Communicating the results of data analytics is not only key to influencing resource allocation but also to attaining accountability from academic units. Tysiac (2015) suggested analytics can be used to sustain remediation of corrective actions. Tracking and reporting compliance issues at the dean and department level increases visibility and inherently promotes

more attention and better management. Data also provides a solid foundation to support interventions that propose changes in policies or processes to address and prevent further compliance issues.

Recommendations

Communication of the results of data analytics is vital to obtaining buy-in from the campus community. Reporting of the results can drive accountability from academic units and cause executive management to realize the value of data analytics as a proactive internal control to ensure financial compliance. Generally, universities recognized the need for effective reporting but identified this as an area lacking in the resources necessary to fully develop reporting capabilities. Further research into the structure of a reporting framework and components that would be most effective in communicating the results of data analytics to academic units and to executive leadership could be beneficial to university research administration offices.

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Appendix A

Survey Instrument

Evaluation of Use of Data Analytics by University Research Administration Offices to Monitor Financial Compliance

Data analytics is increasingly being used as a tool for university research administration offices to monitor financial compliance of grants and other sponsored programs. For this study, data analytics is defined as the process of analyzing sponsored programs data with the objective of drawing meaningful conclusions about the university's financial compliance with federal regulations, sponsor and award terms and conditions, or university policies. The purpose of this study is to better understand the core elements of a successful compliance analytics program. Cindy Todd, a graduate student at Johns Hopkins University, is conducting this survey for use in a research project as part of the thesis requirement for the Masters of Science in Research Administration.

Your participation in the survey is anonymous. The survey does not contain questions that can identify you or your university. By completing this survey, you are consenting to be in this research study. Your participation is voluntary and you can exit the survey at any time.

The survey will take approximately 10 minutes to complete.

Criteria for Participation

1. **By selecting the "Agree" button you are confirming that you are 18 years or older, work at a university in a research administration role, and understand that participation in this research study is voluntary. If any of these statements are not true, please select "Disagree."**
   Mark only one oval.

   ◯ Agree *Skip to question 2.*
   ◯ Disagree *Stop filling out this form.*

Survey

2. **Do your university's research administration offices use data analytics to monitor financial compliance of grants or other sponsored programs?**
   Mark only one oval.

   ◯ Yes *Skip to question 4.*
   ◯ No *Skip to question 3.*

3. **What is the primary reason your university's research administration offices do not use data analytics to monitor financial compliance?**

_____

Stop filling out this form.

4. **To what degree have your university's research administration offices implemented data analytics as a tool to monitor financial compliance of grants or other sponsored programs?**

Mark only one oval.

	0	1	2	3	4	5	
Not started implementation	⬭	⬭	⬭	⬭	⬭	⬭	Completed implementation

5. **How do your university's research administration offices prioritize the financial compliance areas to be monitored using data analytics? (select all that apply)**

Check all that apply.

- ☐ Likelihood of area to be audited
- ☐ Risk assessment of your institution's sponsored programs portfolio
- ☐ Availability of data
- ☐ Other: _____

6. **Did your university's research administration offices collaborate with the institution's Internal Audit office in implementing your data analytics program?**

Mark only one oval.

- ⬭ Yes
- ⬭ No

7. **From a monitoring perspective, what benefits have your university's research administration offices experienced by using data analytics? (select all that apply)**

Check all that apply.

- ☐ Potential problems exposed sooner
- ☐ Greater coverage of grants being monitored
- ☐ Ability to identify trends
- ☐ Other: _____

8. **Do your university's research administration offices provide summary reports to academic units (dean or department level) to communicate the results of data analytics?**

Mark only one oval.

- ◯ Yes
- ◯ No

9. **Do your university's research administration offices provide summary reports to executive leadership, such as the Provost or Vice President of Research, to communicate the results of data analytics?**

Mark only one oval.

- ◯ Yes
- ◯ No

10. **Do your university's research administration offices use trends in data analytic findings, such as recurring types of questioned costs or repeat offending departments, to inform training programs?**

Mark only one oval.

- ◯ Yes
- ◯ No

11. **How would you rate the overall effectiveness of the current data analytics program used by your university's research administration offices to monitor financial compliance of grants or other sponsored programs?**

Mark only one oval.

	1	2	3	4	5	
Ineffective	◯	◯	◯	◯	◯	Effective

12. **In your opinion, what makes for a good data analytics program for a university research administration office?**

13. **What would improve the current data analytics program used by your university's research administrations offices?**

14. **What is your university's annual level of externally-funded research expenditures?**
Mark only one oval.

- ◯ Over $500 million
- ◯ $100-500 million
- ◯ Under $100 million

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Appendix B

Institutional Review Board Approval Letter

Homewood Institutional Review Board
3400 N. Charles Street
Wyman Park Building, Suite N468
Baltimore MD 21218-2685
410-516-6580
http://homewoodirb.jhu.edu/

Michael McCloskey, PhD
IRB Chair

Date: October 15, 2019

PI Name: Jeffrey Kantor
Study #: HIRB00009998
Study Name: Evaluation of Use of Data Analytics by University Research Administration Offices to Monitor Grant Financial Compliance

Date of Review: 10/14/2019
Date of Acknowledgement: 10/14/2019
Expiration Date: 10/14/2022

The above referenced study has been *acknowledged*.

Review Type:	Exempt
Funding Agency:	Not funded
Grant or Contract Number:	
International Sites:	No
Maximum number of participants:	170
Vulnerable populations:	None
Consent process:	
Assent Process:	

No changes may be made to the protocol or the consent form without the approval of the

Board.

To keep the Homewood IRB files current, we are assigning an expiration date to projects that qualify as not human subjects research or exempt. You will receive an email notification prior to the expiration date shown above, providing guidance to extend this project.

Please keep this message in your files for future reference. Thank you for contacting the Homewood IRB about this research and for providing the requested information to make this determination. Your cooperation is greatly appreciated.

Please keep in mind that it is your responsibility to inform the HIRB of any adverse consequences to participants that occur in the course of the study, as well as any complaints from participants regarding the research. In conducting this research, you are required to follow the requirements listed in the *HIRB Policies and Procedures Manual*.

Study Team Members:
Cynthia Todd

APPROVAL IS GRANTED UNDER THE TERMS OF FWA00005834 FEDERAL-WIDE ASSURANCE OF COMPLIANCE WITH DHHS REGULATIONS FOR PROTECTION OF HUMAN RESEARCH SUBJECTS

Appendix C

Responses to Open-Ended Survey Questions

Table C1

Reasons for Not Using Data Analytics

What is the primary reason your university's research administration offices do not use data analytics to monitor financial compliance?	
Institution	Response (raw data)
1	We have recently completed an implementation of the analytic tool associated with our financial system and they are bringing departments on in phases.
2	Lack of resources
3	the data analytics systems are provided by university fiscal leadership and were not designed specific to research administration
4	No product and lack of analytics knowledge
5	Our systems do not currently provide relevant data easily or consistently to use in monitoring. Additionally, the institution is currently upgrading our financial system which has taken priority.
6	We are currently in the process of implementing data analytics with an eRA system that is in the implementation phase.
7	burden involved and then a team needed to monitor
8	Time constraints
9	Inertia
10	Cost and infrastructure
11	Financial constraints
12	no idea
13	Not enough IT resources
14	Lack of data. System limitations

Table C2

Makings of a Good Data Analytics Program

In your opinion, what makes for a good data analytics program for a university research administration office?	
Institution	Response (raw data)
1	
2	Running the program frequently and then disseminating the results widely to the areas that can make an impact (post-award central office, training groups).
3	Transparent data that is accessible and indicative of root causes; not just symptoms.
4	Consistently entered data.
5	
6	Good data
7	Good understanding of current risks and audit trends. A recognition by leadership of the value of the data. An awareness of the likelihood of audit. Linking the data analytics to closeout,.
8	Reports that can be easily run to detect and disseminate material issues in a timely (within 30 days) manner
9	The ability to manage risk without taking time or resources away from other projects.
10	Evolution
11	Action. That is report the data and put processes in place that will minimize or eliminate risk factors.
12	ease of data capture, consistency
13	Ease of application, interpretation
14	
15	Focused resources to aid in the generation and review
16	Good analytics mitigate compliance risk.
17	A deep understanding of the data and the assumptions that are apparent or not so apparent.
18	

Table C3

Improvements Needed to Current Data Analytics Program

What would improve the current data analytics program used by your university's research administration offices?	
Institution	Response (raw data)
1	
2	We need to run it more frequently and increase staffing resources to deal effectively with the results.
3	Additional resources.
4	Consistently entered data.
5	
6	Defining more ways to run data to analyze
7	So far, our program is focused on identifying potentially unallowable costs for central office accountants. They, in turn, work with college and departmental research administrators. I think we need to fine-tune the targets of our program and work to provide consistency across federal agencies.
8	Ability to access all data and dedicated resources to analyze data and develop reports
9	An additional resource who would be solely dedicated to analyzing data.
10	feedback from key departments and completeness of data
11	More focus by senior administration of trends that are potential problems/issues.
12	turn-around time
13	Need a formal program
14	More summarized reporting that could be distributed to department/college administrators, and more robust reporting capabilities to capture information and trends in an accessible, ready-to-go format. Often times, we have tools that monitor for various exceptions, but we need to manipulate the data/reports manually to exclude known exceptions. If we could build these exceptions into the reporting parameters, this would save us time.
15	The ability to connect data from multiple systems
16	Leverage data to create training programs.
17	Ability to pull analytic reports on demand. Many have to be manipulated by hand since the tools can't perform all the functions necessary (i.e. determining what fiscal year a subk went over $25k when doing IDC projections)
18	We are only in the early stages of implementing a program.

Biography

Cindy A. Todd received her Bachelor of Business Administration in Accounting from West Texas A&M University in 1983. She worked in the audit section of a public accounting firm for two years gaining professional certification as a Certified Public Accountant in 1985. She worked in private industry for several years before joining Oklahoma State University in 1994 in University Accounting, and later transferring to Grants and Contracts Financial Administration in 1996. She served as Associate Director of Cost Allocation from 1999 to 2006 with responsibilities for the facilities and administrative cost proposal and recharge centers. In 2006 she joined Baylor University as the Assistant Director of Grants Accounting with responsibilities for the post-award financial administration of sponsored programs. Shortly after joining Baylor she completed her professional certification as a Certified Fraud Examiner. In 2017, she accepted a new role at Baylor University as the Director of Data Analysis and Planning in the Office of the Vice Provost for Research. Her current responsibilities include providing deans, chairs, and executive leadership with research productivity metrics, tracking performance measures related to the services provided by the Office of the Vice Provost for Research, serving as the official source for the reporting of university research data including research expenditures and research staff for the Carnegie Classification, and evaluating programs and initiatives to support the growth of research.